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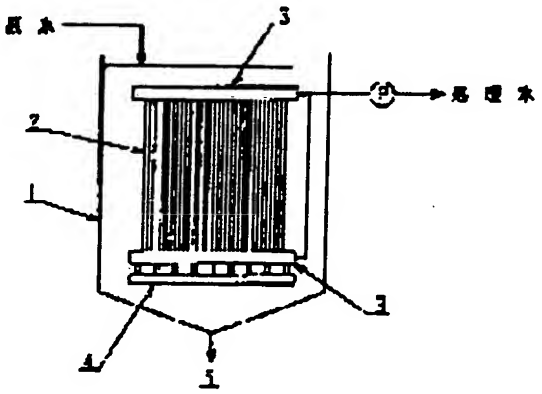
(54) HOLLOW YARN MEMBRANE MODULE ASSEMBLY

(57)Abstract:
PURPOSE: To provide a module assembly capable of filtering highly polluted water with high filtering efficiency.
CONSTITUTION: A module assembly is constituted by fixing both end parts of sheet like hollow yarn membranes 2 by fixing members 3 while holding them to an open state so that the shape of both end parts becomes an almost elongated rectangular shape and arranging a plurality of the elements of the fixed hollow yarn membranes 2 so that the hollow yarn membranes 2 become vertical. The interval between the elements of a module is set to 5-100mm and an air scrubber 4 is arranged between the elements to obtain a hollow yarn membrane module assembly.



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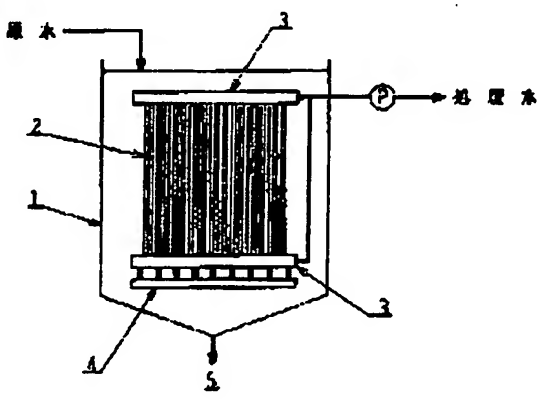
(54)【発明の名称】　中空糸膜モジュール組立体

(57)【要約】

【目的】　本発明は、特に高汚濁性水を高い濾過効率で濾過出来るモジュール組立体を提供する事を目的とする。

【構成】　本発明は、シート状の中空糸膜の両端部を開口状態に保ちつつ、両端部の形状が細長いほぼ矩形となるように固定部材で固定された中空糸膜エレメントを複数個、中空糸膜が垂直となる方向に配置したモジュール組立体に於て、該モジュールのエレメント間隔を5～100mmとし、エレメントの間にエアースクラビング装置を配設した中空糸膜モジュール組立体に関する。



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【特許請求の範囲】

【請求項１】　シート状の中空糸膜の両端部を開口状態に保ちつつ、両端部の形状が細長いほぼ矩形となるように固定部材で固定された中空糸膜エレメントを複数個、中空糸膜が垂直となる方向に配置したモジュール組立体に於て、該モジュールのエレメント間隔を５～１００ｍｍとし、エレメントの間にエアースクラビング装置を配設することを特徴とする中空糸膜モジュール組立体。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、特に汚濁性の高い液体を濾過するのに適した中空糸膜モジュール組立体に関する。

【０００２】

【従来の技術】従来、中空糸膜モジュールは、無菌水、飲料水、高純度水の製造、空気の浄化といった所謂精密濾過の分野に於て多く使用されてきたが、近年、下水処理場における二次処理、三次処理等生物処理における固液分離等に用いる検討が様々な形で行われている。

【０００３】このような用途に用いられる中空糸膜モジュールは、濾過処理時における中空糸膜の目詰まりが大きいために、一定時間濾過処理後、空気を送って中空糸膜を振動させて膜表面を洗浄したり、濾過処理と逆方向に処理水を通水するなどの膜面洗浄を繰り返し行っている。

【０００４】これらの分野の内、特に嫌気性処理で用いられている中空糸膜モジュールは、従来の精密濾過の分野に於て用いられてきた円形状や同心円状に中空糸膜を集束して配置した円筒形タイプのものが殆どであった。

【０００５】最近、中空糸膜の表面積を確保しながら中空糸膜間での被濾過物質の閉塞を防止することを目的にして、中空糸膜を枠部材に取り付けて、一端又は片端が開口する多数の中空糸膜を一列にして両端部を上下の型枠で支持固定すると共に、多数の中空糸膜と連通する濾過液通路を備えた中空糸膜濾過部材を、所定の間隔で連設すると共に、各濾過液通路を連結した中空糸膜濾過器が提案されている（実開平５－６３６３２号、特開平５－２２０３５７号各公報）。

【０００６】更には、中空糸膜をシート状に配置し、中空糸膜の片端部或は両端部が、一つ或は異なる二つのハウジング内の固定部材でそれぞれ開口状態を保ちつつ固定されてなる中空糸膜モジュールであって、固定部材の中空糸膜に垂直な断面の形状がいずれも細長いほぼ矩形である中空糸膜モジュールが提案されている（特開平５－２２０３５６号公報）。

【０００７】このようなシート状の平型の中空糸膜モジュールは、中空糸膜を間隔を設けて均等に配置させることが可能となり、膜面洗浄の際、中空糸膜表面を均等に洗浄することが極めて容易となるので、これまでのような濾過効率の低下を抑えることができるなど、高汚濁性水の濾過に適したモジュールである。

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【０００８】

【発明が解決しようとする課題】本発明は、このようなシート状の中空糸膜モジュールの更なる性能の向上を目的にして発明されたものである。

【０００９】

【課題を解決するための手段】本発明の要旨は、シート状の中空糸膜の両端部を開口状態に保ちつつ、両端部の形状が細長いほぼ矩形となるように固定部材で固定された中空糸膜エレメントを複数個、中空糸膜が垂直となる方向に配置したモジュール組立体に於て、該モジュールのエレメント間隔を５～１００ｍｍとし、エレメントの間にエアースクラビング装置を配設することを特徴とする中空糸膜モジュール組立体にある。

【００１０】シート状の中空糸膜は、中空糸膜を単に配列しただけのものでも差し支えはないが、取扱いのし易さとシートの形状固定による濾過効率の向上の面からは、できるだけ均等に配列されたものが好ましい。

【００１１】本発明の中空糸膜モジュール組立体は、中空糸膜が垂直となる方向に配置されていることが必須である。

【００１２】中空糸膜が水平方向に配置されると、原水に含まれる固形物が中空糸膜に絡み易く、中空糸膜表面に付着した固形物が気泡により離離されにくいという欠点がある。

【００１３】中空糸膜が垂直となる方向に配置されていることによって、上記したような問題点が解消される。

【００１４】以下、本発明を図面に従い具体的に説明する。図１は本発明の中空糸膜モジュール組立体を原水に浸漬した時の一例を示す正面図、図２は中空糸膜モジュールを４個組み合わせた本発明の組立体を原水に浸漬した時の一例を示す側面図である。中空糸膜２は固定部材３で両端を垂直に固定されてエレメントを形成しており、容器１の原水中に浸漬される。

【００１５】エレメントは一つだけを使用しても良いが、処理水量を増やす為に本発明では集水管６等で複数個結合されて、中空糸膜モジュール組立体として使用される。エレメントの間にエアースクラビング装置４を各々設置する。エアースクラビング装置は、閉塞しにくい散気管、エアーノズル等が使われる。

【００１６】本発明の中空糸膜モジュール組立体は、処理槽をコンパクトにするため並びにエアースクラビングを効率よく行うことを考慮すると、隣接するシートの間隔は小さい方が好ましいが、間隔を狭めすぎると汚泥により閉塞が起こり易くなり、またエレメント間を気泡が通り難くなる。

【００１７】逆に広すぎるとコンパクト性が無くなり、気泡が膜表面に接触しにくくなり、エアースクラビング効果が損なわれる。

【００１８】従って、エレメントの間隔には適切な間隔

が要求され、モジュールに占める中空糸膜の膜面積の大きさ、エレメント枚数、集水管の径、エアースクラビング、逆洗等の条件を考慮して選択することが必要であり、その間隔は5～100mmより好ましくは10～70mmの範囲が適当である。

【0019】本発明では、エレメント間に各々エアースクラビング装置を設置することが必須である。エレメント間隔が広いと単にモジュールの下部に散気管を一つ取り付けて強力にエアースクラビングしてみても、気泡の接触は中空糸膜の表面に十分行き渡らない。

【0020】エアースクラビング装置の設置場所は中空糸膜モジュールの下部から上方に散気或はエアージェットする。

【0021】本発明の中空糸膜モジュール組立体は、周期的に一時吸引を停止する所謂間欠吸引運転方法を採用するのが好ましく、堆積物が膜面に固着することを効果的に防止することが出来る。

【0022】中空糸膜は、例えばセルロース系、ポリオレフィン系、ポリビニルアルコール系、ポリスルフォン系等の各種材料からなるものが使用でき、特にはポリエチレン、ポリプロピレンなどの強伸度の高い材質のものが好ましい。

【0023】濾過膜として使用可能なものであれば、孔径、空孔率、膜厚、外径等には特に制限はないが、除去対象物や容積当たりの膜面積の確保及び中空糸膜の強度等を考えると、好ましい例としては、孔径0.01～1μm、空孔率20～90%、膜厚5～300μm、外径20～2000μmの範囲を挙げることができる。

【0024】また、バクテリアの除去を目的とする場合の孔径は0.2μm以下であることが必須となり、有機物やウイルスの除去を目的とする場合には分画分子量数万から数十万の限外濾過膜を用いる場合もある。

【0025】中空糸膜の表面特性としては表面に親水性基等を持つ所謂恒久親水化膜であることが望ましい。但＊

＊久親水化膜の製法としては、ポリビニルアルコール系のような親水性高分子で中空糸膜を製造する方法又は疎水性高分子膜の表面を親水化する方法など公知の方法が使用できる。

【0026】例えば親水性高分子を膜面に付与し疎水性中空糸膜を親水化する際の親水性高分子の例としては、エチレン－酢酸ビニル共重合体のけん化物（＝エチレン－ビニルアルコール共重合体）、ポリビニルピロリドン等を挙げることができる。

【0027】上記の疎水性膜を親水性高分子で親水化した膜は、有機物との疎水性相互作用を減少させ、膜面への有機物吸着量を減少させることが出来るというメリットを有する。

【0028】

【発明の効果】本発明の中空糸膜モジュール組立体は、大きい膜面積でありながらコンパクトな構造になっており、且つ、より多くの中空糸膜が直接被処理水と接触するので、中空糸膜間の固着一体化が防止され、特に高汚濁性水の濾過において、長期にわたり高い濾過効率を保ちながら濾過水を得ることが可能である。

【図面の簡単な説明】

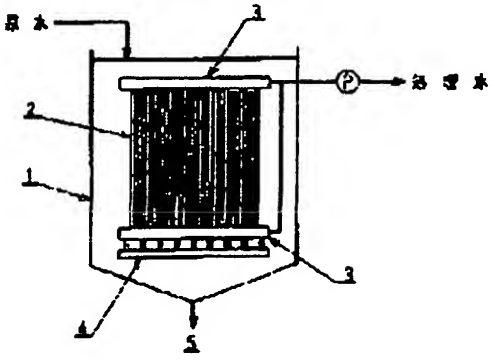
【図1】本発明の中空糸膜モジュール組立体を原水に浸漬した時の一例を示す正面図である。

【図2】中空糸膜モジュールを4個組み合わせた本発明の組立体を原水に浸漬した時の一例を示す側面図である。

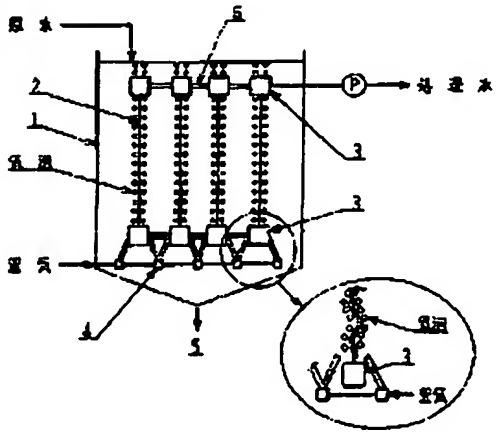
【符号の説明】

1　容器
2　中空糸膜
3　固定部材
4　エアースクラビング装置
5　沈殿物
6　集水管

【図1】



【図2】



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CLAIMS

[Claim(s)]
[Claim 1] The hollow fiber module assembly with which the configuration of both ends sets element spacing of this module to 5-100mm in the module assembly which has arranged two or more long and slender hollow fiber elements fixed by the holddown member so that it might become a rectangle mostly in the direction which becomes vertical [a hollow fiber], and is characterized by arranging Ayr scrubbing equipment between elements, maintaining the both ends of a sheet-like hollow fiber at an opening condition.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the hollow fiber module assembly suitable for filtering the high liquid of especially corruption nature.
[0002]
[Description of the Prior Art] Conventionally, although many hollow fiber modules have been used in the so-called field of precision filtration, such as manufacture of non-bacterial water, potable water, and a high purity water, and clarification of air, they are performed in recent years in the form with various examination used for the solid liquid separation in biological treatment, such as secondary treatment in a sewage disposal plant, and tertiary treatment, etc.
[0003] Since the blinding of the hollow fiber at the time of filtration processing is large, after fixed time amount filtration processing, the hollow fiber module used for such an application sends air, vibrates a hollow fiber, a film front face is washed, or repeats film surface washing of letting treated water flow to filtration processing and hard flow, and is performing it.
[0004] The thing of the cylindrical shape type which converged and has arranged the hollow fiber the shape of a circle configuration or a concentric circle for which the hollow fiber module used especially by the anaerobic treatment among these fields has been used in the field of the conventional precision filtration was almost the case.
[0005] It aims at preventing lock out of the filtered matter between hollow fibers, securing the surface area of a hollow fiber recently. While attaching a hollow fiber in frame part material, making into a single tier the hollow fiber of a large number in which an end or one end carries out opening and carrying out support immobilization with the shuttering of the upper and lower sides of both ends While forming successively many hollow fibers and the hollow fiber filtration members equipped with the filtrate path open for free passage at the predetermined spacing, the hollow fiber filter which connected each filtrate path is proposed (JP,5-63632,U and JP,5-220357,A each official report).
[0006] Furthermore, it is the hollow fiber module which it comes to fix, arranging a hollow fiber in the shape of a sheet, and the piece edge or both ends of a hollow fiber maintaining an opening condition by the holddown member in one or two different housing, respectively, and the long and slender hollow fiber module which is a rectangle mostly is proposed for each configuration of a cross section vertical to the hollow fiber of a holddown member (JP,5-220356,A).
[0007] Since it becomes possible to prepare an interlayer spacing and to arrange a hollow fiber of such a hollow fiber module of a sheet-like flat tip uniformly, and it becomes very easy to wash a hollow fiber front face uniformly in case it is film surface washing, it is a module suitable for filtration of high corruption **** that decline in a filtration efficiency like the former can be suppressed etc.
[0008]
[Problem(s) to be Solved by the Invention] This invention is invented for the purpose of improvement in the further engine performance of the hollow fiber module of the shape of such a sheet.

[0009]
[Means for Solving the Problem] Maintaining the both ends of a sheet-like hollow fiber at an opening condition, the configuration of both ends sets element spacing of this module to 5-100mm in the module assembly with which the hollow fiber has arranged two or more long and slender hollow fiber elements fixed by the holddown member so that it might become a rectangle mostly in the direction which becomes vertical, and the summary of this invention is in the hollow fiber module assembly characterized by arranging Ayr scrubbing equipment between elements.
[0010] Although inconvenience does not have that to which the sheet-like hollow fiber only arranged the hollow fiber, either, from the ease of carrying out of handling, and the field of improvement in the filtration efficiency by configuration immobilization of a sheet, what was arranged as uniformly as possible is desirable.
[0011] As for the hollow fiber module assembly of this invention, it is indispensable to be arranged in the direction in which a hollow fiber becomes vertical.
[0012] When a hollow fiber is arranged horizontally, there is a fault that the solid with which the solid contained in raw water tended to be involved in the hollow fiber, and adhered to the hollow fiber front face cannot exfoliate easily due to air bubbles.
[0013] A trouble which was described above is canceled by being arranged in the direction in which a hollow fiber becomes vertical.
[0014] Hereafter, this invention is concretely explained according to a drawing. The front view showing an example when drawing 1 is immersed in raw water in the hollow fiber module assembly of this invention, and drawing 2 are the side elevations showing an example when the assembly of this invention which combined four hollow fiber modules being immersed in raw water. Ends are vertically fixed by the holddown member 3, the hollow fiber 2 forms the element, and it is immersed into the raw water of a container 1.
[0015] Although an element may use only one, in order to increase quality of water to be treated, by this invention, in catchment tubing 6 grade, it is combined by more than one and it is used as a hollow fiber module assembly. Ayr scrubbing equipment 4 is respectively installed between elements. A powder trachea, an air jet hole, etc. which cannot blockade Ayr scrubbing equipment easily are used.
[0016] In order that the hollow fiber module assembly of this invention may use a processing tub as a compact, when it takes into consideration performing Ayr scrubbing in a list efficiently, the smaller one of spacing of an adjoining sheet is desirable but, if spacing is narrowed too much, lock out will become easy to take place with sludge, and air bubbles will stop being able to pass along between elements easily.
[0017] Conversely, if too large, compactability will be lost, air bubbles stop being able to contact a film front face easily, and the Ayr scrubbing effectiveness is spoiled.
[0018] Therefore, it is required to choose in consideration of conditions, such as a path of the magnitude of the film surface product of the hollow fiber which suitable spacing for spacing of an element is required and is occupied to a module, element number of sheets, and catchment tubing, Ayr scrubbing, and a back wash, and the range of 10-70mm is more preferably [than 5-100mm] suitable for the spacing.
[0019] It is indispensable to install Ayr scrubbing equipment respectively between elements in this invention. If element spacing is large, even if it will attach one powder trachea in the modular lower part and will only carry out Ayr scrubbing to it powerfully, contact of air bubbles does not spread enough on the surface of a hollow fiber.
[0020] the installation of Ayr scrubbing equipment -- the upper part from the lower part of a hollow fiber module -- aeration -- or an air jet is carried out.
[0021] As for the hollow fiber module assembly of this invention, it is desirable to adopt the so-called intermittent attraction operating method which stops attraction periodically temporarily, and it can prevent effectively that a deposit fixes to a film surface.
[0022] What consists of various ingredients, such as a cellulose type, a polyolefine system, a polyvinyl alcohol system, and a polysulfone system, can be used for a hollow fiber, and its thing of high construction material of strong ductility, such as polyethylene and polypropylene, is especially desirable.
[0023] Although there will be especially no limit in an aperture, a void content, thickness, and an outer diameter

if usable as a filtration membrane, considering a clearance object, reservation of the film surface product per volume, the reinforcement of a hollow fiber, etc., as a desirable example, 0.01-1 micrometer of apertures, 20 - 90% of void contents, 5-300 micrometers of thickness, and the range of 20-2000-micrometer outer diameter can be mentioned.

[0024] Moreover, the aperture in the case of aiming at clearance of bacteria may use hundreds of thousands of ultrafiltration membrane from 10,000 cuts off molecular weight, when it becomes indispensable that it is 0.2 micrometers or less and it aims at clearance of the organic substance or a virus.

[0025] It is desirable that it is the so-called lasting hydrophilization film which has a hydrophilic radical etc. in a front face as a surface characteristic of a hollow fiber. Well-known approaches, such as the approach of carrying out hydrophilization of the front face of the approach or hydrophobic poly membrane which manufactures a hollow fiber with a hydrophilic macromolecule like a polyvinyl alcohol system as a process of the lasting hydrophilization film, can be used.

[0026] For example, as an example of the hydrophilic giant molecule at the time of giving a hydrophilic giant molecule to a film surface and carrying out hydrophilization of the hydrophobic hollow fiber, the saponification object (= ethylene-vinylalcohol copolymer) of an ethylene-vinylacetate copolymer, a polyvinyl pyrrolidone, etc. can be mentioned.

[0027] The film which carried out hydrophilization of the above-mentioned hydrophobic film with the hydrophilic macromolecule has the merit that a hydrophobic interaction with the organic substance can be decreased and the organic substance amount of adsorption to a film surface can be decreased.

[0028]

[Effect of the Invention] a film surface product with the large hollow fiber module assembly of this invention -- it is -- ** et al. -- since it has compact structure and more hollow fibers contact direct processed water, the fixing unification between hollow fibers prevents -- having -- especially -- filtration of high corruption **** -- setting -- a long period of time -- a rear spring supporter -- it is possible to obtain filtered water, maintaining a high filtration efficiency.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the hollow fiber module assembly suitable for filtering the high liquid of especially corruption nature.

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PRIOR ART

[Description of the Prior Art] Conventionally, although many hollow fiber modules have been used in the so-called field of precision filtration, such as manufacture of non-bacterial water, potable water, and a high purity water, and clarification of air, they are performed in recent years in the form with various examination used for the solid liquid separation in biological treatment, such as secondary treatment in a sewage disposal plant, and tertiary treatment, etc.

[0003] Since the blinding of the hollow fiber at the time of filtration processing is large, after fixed time amount filtration processing, the hollow fiber module used for such an application sends air, vibrates a hollow fiber, a film front face is washed, or repeats film surface washing of letting treated water flow to filtration processing and hard flow, and is performing it.

[0004] The thing of the cylindrical shape type which converged and has arranged the hollow fiber the shape of a circle configuration or a concentric circle for which the hollow fiber module used especially by the anaerobic treatment among these fields has been used in the field of the conventional precision filtration was almost the case.

[0005] It aims at preventing lock out of the filtered matter between hollow fibers, securing the surface area of a hollow fiber recently, A hollow fiber is attached in frame part material, and while forming successively the hollow fiber filtration members equipped with many hollow fibers and a filtrate path open for free passage while an end or one end made the single tier the hollow fiber of a large number which carry out opening and carried out support immobilization with the shuttering of the upper and lower sides of both ends at the predetermined spacing, the hollow fiber filter which connected each filtrate path is proposed (JP,5-63632,U and JP,5-220357,A each official report).

[0006] Furthermore, it is the hollow fiber module which it comes to fix, arranging a hollow fiber in the shape of a sheet, and the piece edge or both ends of a hollow fiber maintaining an opening condition by the holddown member in one or two different housing, respectively, and the long and slender hollow fiber module which is a rectangle mostly is proposed for each configuration of a cross section vertical to the hollow fiber of a holddown member (JP,5-220356,A).

[0007] Since it becomes possible to prepare an interlayer spacing and to arrange a hollow fiber of such a hollow fiber module of a sheet-like flat tip uniformly, and it becomes very easy to wash a hollow fiber front face uniformly in case it is film surface washing, it is a module suitable for filtration of high corruption **** that decline in a filtration efficiency like the former can be suppressed etc.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is invented for the purpose of improvement in the further engine performance of the hollow fiber module of the shape of such a sheet.

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MEANS

[Means for Solving the Problem] Maintaining the both ends of a sheet-like hollow fiber at an opening condition, the configuration of both ends sets element spacing of this module to 5-100mm in the module assembly with which the hollow fiber has arranged two or more long and slender hollow fiber elements fixed by the holddown member so that it might become a rectangle mostly in the direction which becomes vertical, and the summary of this invention is in the hollow fiber module assembly characterized by arranging Ayr scrubbing equipment between elements.
[0010] Although inconvenience does not have that to which the sheet-like hollow fiber only arranged the hollow fiber, either, from the ease of carrying out of handling, and the field of improvement in the filtration efficiency by configuration immobilization of a sheet, what was arranged as uniformly as possible is desirable.
[0011] As for the hollow fiber module assembly of this invention, it is indispensable to be arranged in the direction in which a hollow fiber becomes vertical.
[0012] When a hollow fiber is arranged horizontally, there is a fault that the solid with which the solid contained in raw water tended to be involved in the hollow fiber, and adhered to the hollow fiber front face cannot exfoliate easily due to air bubbles.
[0013] A trouble which was described above is canceled by being arranged in the direction in which a hollow fiber becomes vertical.
[0014] Hereafter, this invention is concretely explained according to a drawing. The front view showing an example when drawing 1 is immersed in raw water in the hollow fiber module assembly of this invention, and drawing 2 are the side elevations showing an example when the assembly of this invention which combined four hollow fiber modules being immersed in raw water. Ends are vertically fixed by the holddown member 3, the hollow fiber 2 forms the element, and it is immersed into the raw water of a container 1.
[0015] Although an element may use only one, in order to increase quality of water to be treated, by this invention, in catchment tubing 6 grade, it is combined by more than one and it is used as a hollow fiber module assembly. Ayr scrubbing equipment 4 is respectively installed between elements. A powder trachea, an air jet hole, etc. which cannot blockade Ayr scrubbing equipment easily are used.
[0016] In order that the hollow fiber module assembly of this invention may use a processing tub as a compact, when it takes into consideration performing Ayr scrubbing in a list efficiently, the smaller one of spacing of an adjoining sheet is desirable but, if spacing is narrowed too much, lock out will become easy to take place with sludge, and air bubbles will stop being able to pass along between elements easily.
[0017] Conversely, if too large, compactability will be lost, air bubbles stop being able to contact a film front face easily, and the Ayr scrubbing effectiveness is spoiled.
[0018] Therefore, it is required to choose in consideration of conditions, such as a path of the magnitude of the film surface product of the hollow fiber which suitable spacing for spacing of an element is required and is occupied to a module, element number of sheets, and catchment tubing, Ayr scrubbing, and a back wash, and the range of 10-70mm is more preferably [than 5-100mm] suitable for the spacing.
[0019] It is indispensable to install Ayr scrubbing equipment respectively between elements in this invention. If element spacing is large, even if it will attach one powder trachea in the modular lower part and will only carry

out Ayr scrubbing to it powerfully, contact of air bubbles does not spread enough on the surface of a hollow fiber.
[0020] the installation of Ayr scrubbing equipment -- the upper part from the lower part of a hollow fiber module -- aeration -- or an air jet is carried out.
[0021] As for the hollow fiber module assembly of this invention, it is desirable to adopt the so-called intermittent attraction operating method which stops attraction periodically temporarily, and it can prevent effectively that a deposit fixes to a film surface.
[0022] What consists of various ingredients, such as a cellulose type, a polyolefine system, a polyvinyl alcohol system, and a polysulfone system, can be used for a hollow fiber, and its thing of high construction material of strong ductility, such as polyethylene and polypropylene, is especially desirable.
[0023] Although there will be especially no limit in an aperture, a void content, thickness, and an outer diameter if usable as a filtration membrane, considering a clearance object, reservation of the film surface product per volume, the reinforcement of a hollow fiber, etc., as a desirable example, 0.01-1 micrometer of apertures, 20 - 90% of void contents, 5-300 micrometers of thickness, and the range of 20-2000-micrometer outer diameter can be mentioned.
[0024] Moreover, the aperture in the case of aiming at clearance of bacteria may use hundreds of thousands of ultrafiltration membrane from 10,000 cuts off molecular weight, when it becomes indispensable that it is 0.2 micrometers or less and it aims at clearance of the organic substance or a virus.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the front view showing an example when the hollow fiber module assembly of this invention being immersed in raw water.
[Drawing 2] It is the side elevation showing an example when the assembly of this invention which combined four hollow fiber modules being immersed in raw water.
[Description of Notations]
1 Container
2 Hollow Fiber
3 Holddown Member
4 Ayr Scrubbing Equipment
5 Precipitate
6 Catchment Tubing

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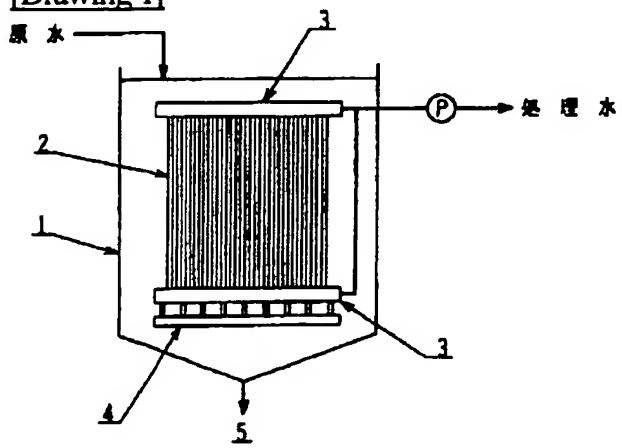
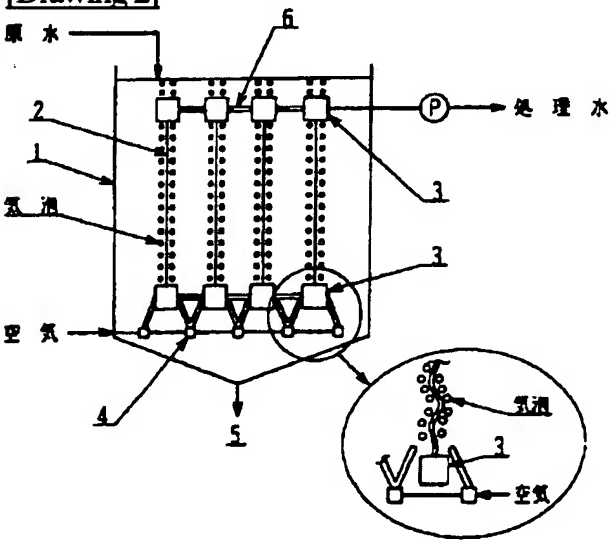
DRAWINGS

[Drawing 1]



[Drawing 2]



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